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(71) Applicants
KK Daini Seikosha,
(Japan),
31-1 6-chome,
Kameido,
Koto-ku,
Tokyo,
Japan.
(72) Inventors
Akira Yamazawa,
Fujio Tamura.
(74) Agent and/or Address for Service
J. Miller and Co.,
Lincoln House,
296-302 High Holborn,
London WC1V 7JH.

(54) **Stethoscope**

(57) A stethoscope has an electrically conductive resonant plate (2) arranged to contact the chest or other part of a human body, a support structure (6) on which the resonant plate is mounted and an electrode (7) mounted on the support structure but electrically insulated from the resonant plate. The electrode is arranged to be touched by a finger or other part of the human body. A pulse rate measuring circuit (Figure 3) is connected to receive an electrocardiac potential signal induced between the resonant plate and the electrode for measuring heart or pulse rate. The heart or pulse rate is determined from the interval between pulses. A display device (4) displays the heart or pulse rate.

Fig. 1B.

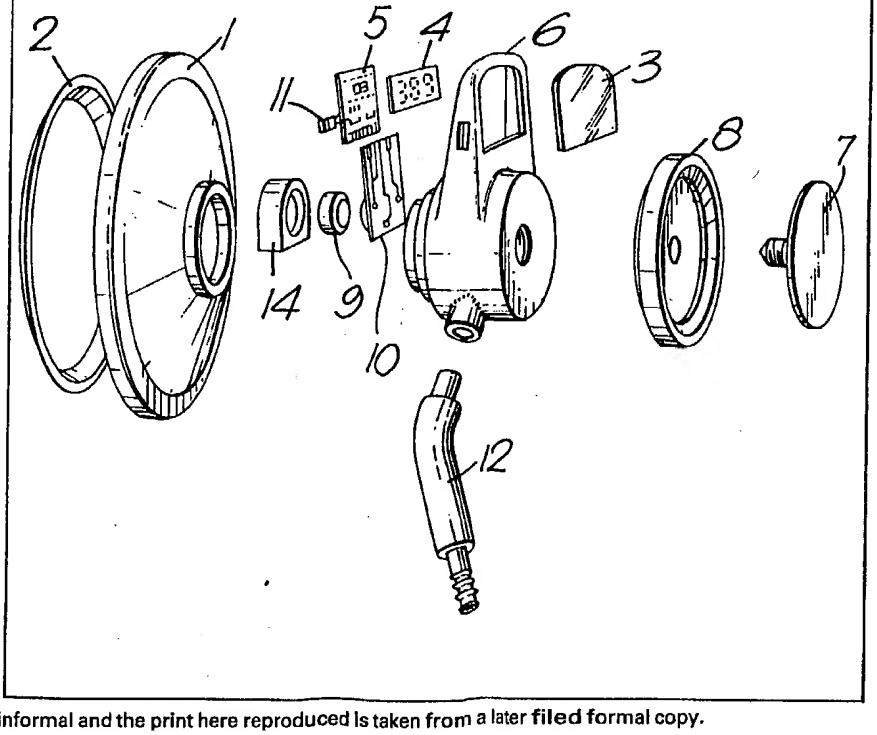


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Fig.1A.

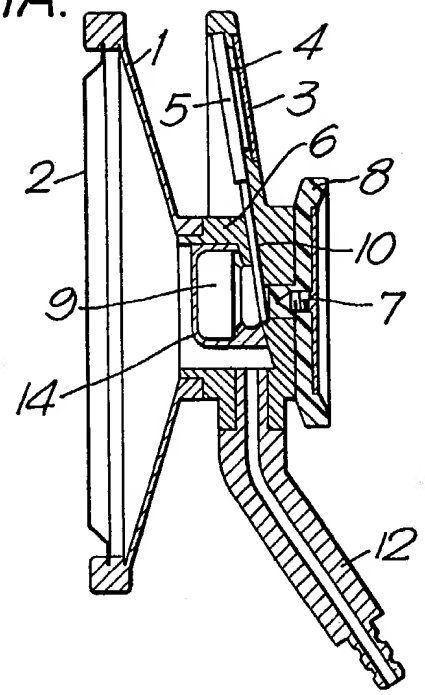



Fig. 1B.

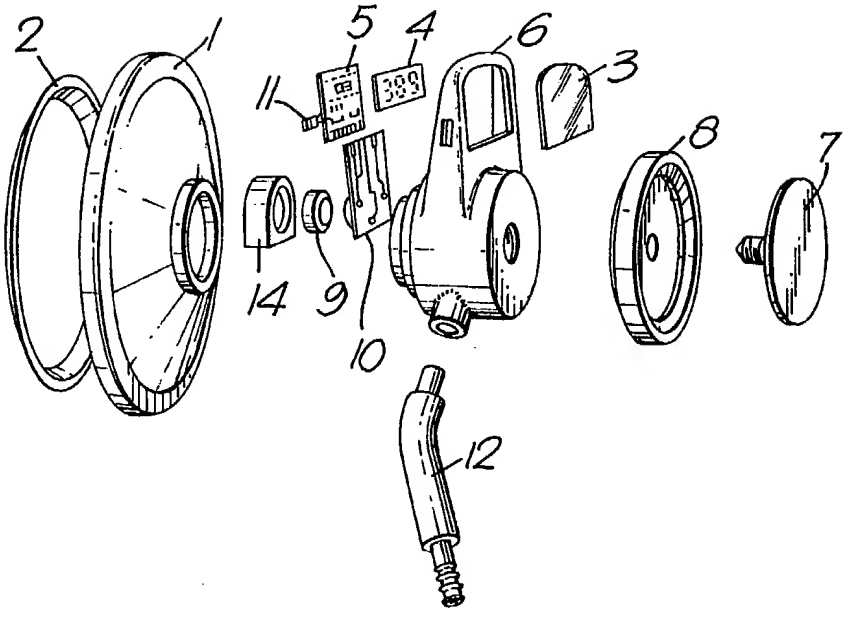


Fig. 2.

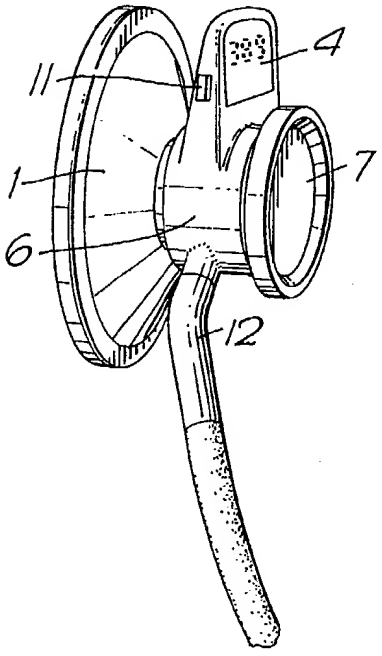
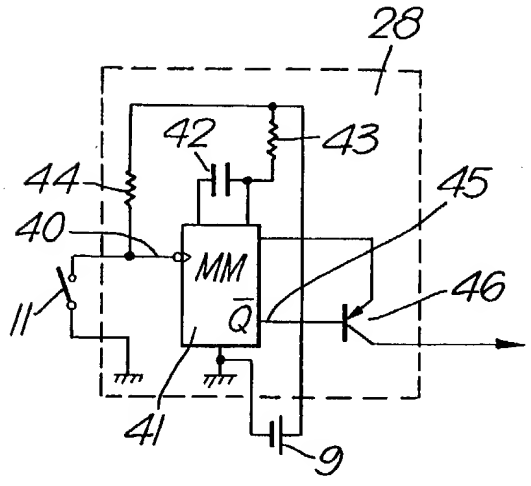



Fig. 4.



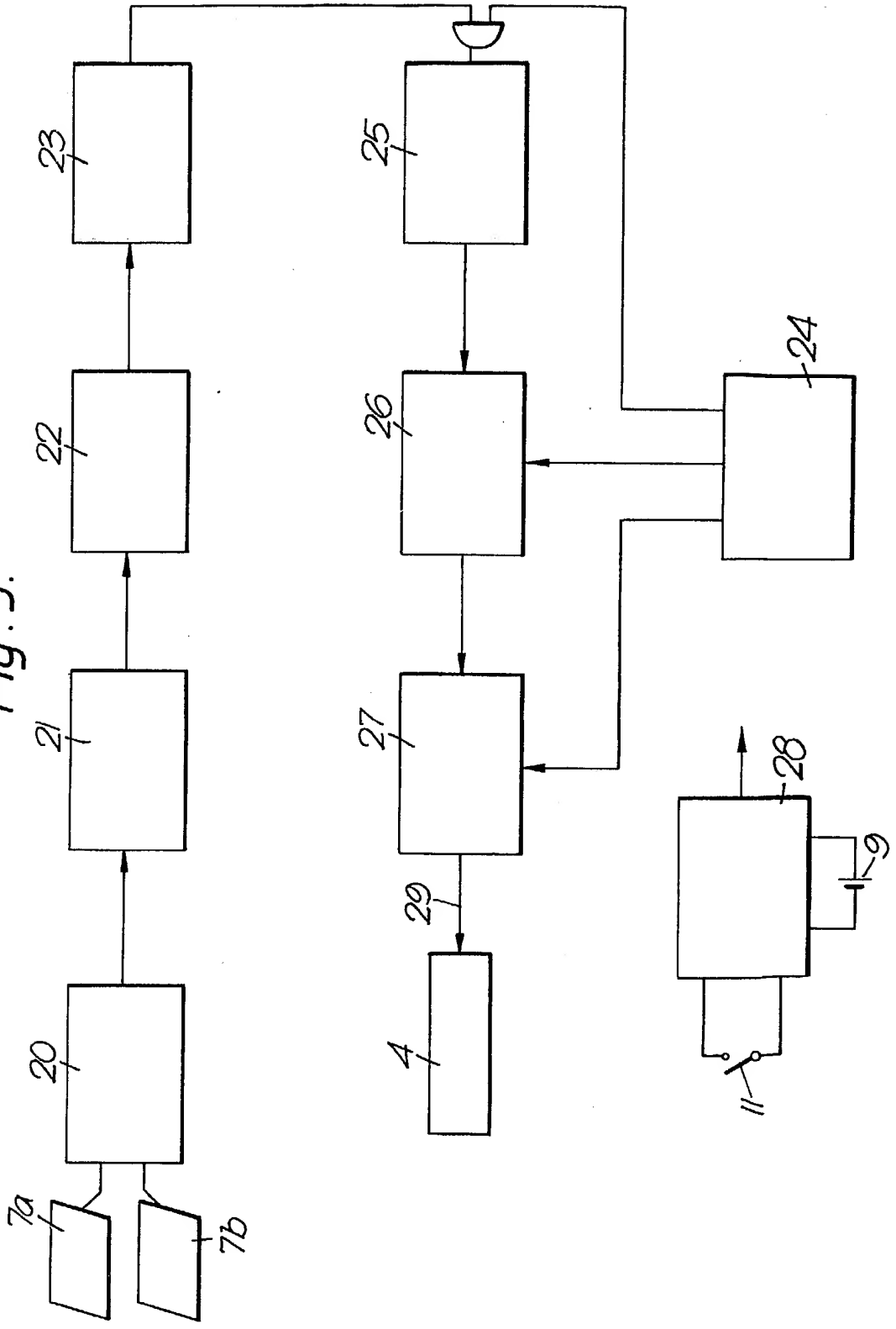



Fig. 3.

SPECIFICATION

**Stethoscope**

This invention relates to stethoscopes.

According to the present invention there is provided a stethoscope having an electrically conductive resonant plate arranged to contact the chest or other part of a human body, support structure on which the resonant plate is mounted, an electrode mounted on the support structure but electrically insulated from the resonant plate, the electrode being arranged to be touched by a finger or other part of the human body, a pulse rate measuring circuit connected to receive an electrocardiac potential signal induced between the resonant plate and the electrode for measuring heart or pulse rate, and a display device for displaying the heart or pulse rate.

The resonant plate may be connected electrically through a stethoscope body to the pulse rate measuring circuit.

In the preferred embodiment the pulse rate measuring circuit is mounted on a circuit board located in the support structure between the resonant plate and the electrode.

The display device is preferably mounted in the support structure.

The strethoscope preferably includes a battery located in the support structure between the resonant plate and the electrode.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

*Figure 1A* is a sectional view of one embodiment of a stethoscope according to the present invention;

*Figure 1B* is an exploded view of the stethoscope of Figure 1A;

*Figure 2* is a perspective view of the stethoscope of Figure 1A;

*Figure 3* is a block diagram of an electronic pulse rate measuring circuit of the stethoscope of Figure 1A; and

*Figure 4* is a circuit diagram of an automatic power circuit of the electronic pulse rate measuring circuit of Figure 3.

Figure 1A illustrates one embodiment of a stethoscope according to the present invention and Figure 1B is an exploded view thereof. A stethoscope body 1 and a resonant plate 2 are made of metal so that they can be brought into electrical contact with the chest or other part of a patient. An electronic pulse rate measuring circuit described in greater detail later with reference to Figure 3 and 4 is mounted on a circuit board 5 connected with a display panel 4. The circuit board 5, the display panel 4, a conduit 12, a cover glass 13 for the display panel, a battery cover 14 and a battery 9 are mounted on a support structure 6. An electrode 7 is electrically insulated from the support structure 6 by an electrically insulating member 8 made of, for example, synthetic resin.

In operation, the resonant plate 2 is applied to the patient's chest and the electrode 7 is touched by the patient's fingertip. The electronic pulse rate measuring circuit measures heart or pulse rate by an electrocardiac potential signal induced between the resonant plate 2 and the electrode 7. The heart or pulse rate is displayed by the display panel 4. The electrode 7, the circuit board 5 and the battery 9 are connected by a wiring board 10. The battery 9 can be replaced by detaching the battery cover 14 after removing the stethoscope body 1 from the support structure 6.

Figure 2 is a perspective view of the stethoscope of Figure 1A showing the support structure 6 housing the display panel 4 which displays the heart or pulse rate, a power switch 11, the electrode 7, and a rubber tube 13 inserted over the conduit 12. The pulse rate measuring circuit becomes operative by turning the power from the battery 9 on by closing the power switch 11. The power is turned off automatically after a predetermined time.

The drawings only show part of one embodiment of a stethoscope according to the present invention, the parts, for example, ear pieces, which are not shown are those necessary to permit the stethoscope to be used by a doctor or nurse in the conventional manner.

Figure 3 is a block diagram of the pulse rate measuring circuit of the stethoscope of Figure 1A. An electrode 7*a* corresponds to to the electrode 7 and an electrode 7*b* corresponds to the resonant plate 2. The electrodes 7*a*, 7*b* are connected to a pre-amplifier 20 which amplifies the electrocardiac potential signal to improve the signal-to-noise ratio. An output signal from the preamplifier 20 is fed to a band-pass filter 21 to eliminate unnecessary frequency components outside the expected frequency range of the electrocardiac potential signal. An output signal from the band-pass amplifier 21 is amplified by a main amplifier 22. An output signal from the main amplifier is fed to a level detector 23 to provide a pulsiform signal derived from the electrocardiac potential signal. The pulsiform signal from the level detector 23 switch a gate 30 of a counter 25.

A clock signal from a clock generator 24 is also applied to the gate of the counter 25. The value counted by the counter 25 is directly proportional to the interval between the pulses of the pulsiform signal from the level detector 23. Namely, the value counted by the counter 25 is directly proportional to the period of the pulsiform signal. The value counted by the counter 25 is then fed to a counting circuit 26 which produces an output signal proportional to the member of pulses/minute. The output signal from the counting circuit is converted into a segment data signal 29 by a decoder 27 and fed to the display panel 4 to display heart or pulse rate as a number of beats per minute. The clock signal from the clock generator 24 is supplied to the counting circuit 26 and the decoder 27.

An automatic power circuit 28 controls the power supplied from the battery 9 to the electronic pulse rate measuring circuit so that after the power switch 11 has been pressed once power is applied to the pulse rate measuring circuit for a predetermined period of time and then the power is automatically turned off. As shown in Figure 4 the automatic

ides a mono-stable multi-vibrator

41 which can be triggered to enable the electronic pulse rate measuring circuit to start counting pulses at any time. Since the power switch 11 need not be opened manually and since the power is turned off automatically after a predetermined period of time, consumption of the battery is reduced. The automatic power circuit 28 has a capacitor 42 for determining the predetermined period of time power is applied to the pulse rate measuring circuit after the power switch 11 has been pressed, a register 43, a pull-up resistor 44 connected to an input terminal 40 for triggering the mono-stable multi-vibrator 41 when the power switch 11 is closed, and a transistor 46 which is a power source switch controlled by a signal at an output terminal 45 of the mono-stable multi-vibrator 41. The transistor 46 remains conductive for a predetermined period of time to provide power to the electronic pulse rate measuring circuit.

The stethoscope according to the present invention and illustrated above includes an electronic pulse rate measuring circuit producing an indication of heart or pulse rate from the electrocardiac potential signal between the patient's chest and fingertip. Thus, examination of a patient by the stethoscope and counting of heart or pulse rate are simultaneously performed so that examination time is reduced, patient fatigue is relieved and doctors or nurses labour reduced. The position of the display panel 4 in the support structure 6 is such that the heart or pulse rate can be seen by the doctor or nurse whilst the patient's chest or other part of the body is being examined by the stethoscope in the conventional manner.

## CLAIMS

1. A stethoscope having an electrically conductive resonant plate arranged to contact the chest or other part of a human body, a support structure on which the resonant plate is mounted, an electrode mounted on the support structure but electrically insulated from the resonant plate, the electrode being arranged to be touched by a finger or other part of the human body, a pulse rate measuring circuit connected to receive an electrocardiac potential signal induced between the resonant plate and the electrode for measuring heart or pulse rate, and a display device for displaying the heart or pulse rate.

2. A stethoscope as claimed in claim 1 in which the resonant plate is connected electrically through a stethoscope body to the pulse rate measuring circuit.

3. A stethoscope as claimed in claim 1 or 2 in which the pulse rate measuring circuit is mounted on a circuit board located in the support structure between the resonant plate and the electrode.

4. A stethoscope as claimed in any preceding claim in which the display device is mounted in the support structure.

5. A stethoscope as claimed in any preceding claim including a battery located in the support structure between the resonant plate and the electrode.

6. A stethoscope substantially as herein described with reference to and as shown in the accompanying drawings.

7. In a stethoscope with a conductive resonant plate for touching with a breast portion of a human being having a supporting portion, the improvement comprising an electrode for touching with finger, a circuit board for connecting electrically the conductive resonant plate and the electrode, and a display device for indicating a pulse based on an electrocardiac potential.

8. A stethoscope claimed in claim 7, wherein the display surface of the display device is opposite to the touching surface of the conductive resonant plate.

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